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Recent observations and notes on the ecology of the Royal Sunangel *Heliangelus regalis*

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Between July and September 1994, a team comprising five British and Peruvian ornithologists carried out surveys on the Cordillera de Colán, a semi-isolated mountain range in Amazonas department, northern Peru. The fieldwork was conducted as part of a conservation project organised from the University of Cambridge in the U.K. and the Asociación Peruana para la Conservación de la Naturaleza (APECO) in Peru. The aims of this project were to assess the habitat requirements and conservation status of the threatened, restricted-range and poorly known birds of the remaining elfin and cloud forest. The surveys were conducted at 1500–2650 m at two locations in the southern part of the range. A number of bird species of conservation interest were recorded, including the Royal Sunangel *Heliangelus regalis*, a hummingbird threatened with global extinction.

Status

This species was discovered in 1975 by Fitzpatrick *et al.* (1979) at 1800–2200 m above San José Loudres on the Cordillera del Condor, northern Cajamarca (c. 5°02'S, 78°51'W). Two males were subsequently collected by Davis (1986) at 1450 m north-east of Jirillo, San Martín (c. 6°03'S, 76°44'W). Habitat destruction and fragmentation within the Royal Sunangel's restricted range have led to it being listed as Vulnerable in Collar *et al.* (1994).

Expedition records

Between 16 and 31 August 1994 we made 45 observations of males and 44 of females in two areas north of the village of San Cristobal (5°50'S, 78°13'W): one on a ridgetop at 1950 m, the other at 1750 m. Most males (60%) were observed on the ridgetop and a maximum of three were seen together at any one time. In contrast, the majority of females (95.5%) were observed at the lower area. Two of the records of males were presumed to be immatures. The plumage of these individuals was flecked with grey, as described for subadults by Davis (1986), and the tail appeared shorter than that of other males.

Habitat

The sunangel was observed in a habitat we termed 'elfin scrub'. This habitat bordered elfin forest within the humid lower montane zone (as defined by Holdridge *et al.* 1971). Elfyn scrub occurred upon sandy soils with up to 40% exposed rock, and consisted of grassland with scattered dead trees and stunted lichen-covered bushes (including *Clusia* sp.). Ericaceous plants, succulents and moss were common. Bracken ferns and flowering plants were abundant, and included at least three members of Orchidaceae, two of shrubby Compositae, and the flowering melastome *Brachyotum quinquenerve*. This latter species, previously noted as being the preferred nectar source of the Royal Sunangel (Fitzpatrick *et al.* 1979), was the most abundant flowering species in the area of elfin scrub at 1950 m. At the lower area however, *B. quinquenerve* was rare. In common with the habitat where Fitzpatrick *et al.* (1979) discovered the sunangel, there was evidence of regular fire disturbance in the elfin scrub. It is likely that fire, both natural and unnatural, plays an important role in shaping this habitat.

Foraging behaviour

At 1950 m, males were observed moving from flower to flower on *Brachyotum quinquenerve* bushes, usually at 0–2 m above the ground, occasionally perching on the ground to feed on low flowers. The sunangel typically fed on the nectar of approximately 3–4 flowers before perching for 3–5 seconds, during which time it usually wiped its bill upon a stem. Three modes of nectar foraging were observed: one in which the bird hovered while feeding upon nectar, one in which the bird perched on a stem below the flower and extracted nectar through the corolla (as noted by Fitzpatrick *et al.* 1979), and the third whereby the bird perched and extracted nectar through the base of the corolla. In the latter mode, the sunangel seemed to use existing holes, possibly made by flower-piercers *Diglossa* spp., a practice observed in other Andean hummingbirds (Fjeldså & Krabbe 1990). Both Rusty Flower-piercer *Diglossa sittoides* and Bluish Flower-piercer *D. caeruleascens* were observed feeding within the territory of one male at 1950 m.

Fitzpatrick *et al.* (1979) estimated that in 25% of flower visits the Royal Sunangel perched, rather than hovered whilst feeding. Our observations gave a figure closer to 40% ($n=400$), and 25% of these made use of the possible flower-piercer holes. The sunangel was never observed sallying for insects as described by Fitzpatrick *et al.* (1979). Female sunangels were typically seen feeding upon the nectar of ericaceous plants at 1750 m, and seemed to return to clusters of these flowers every *c.* 40 minutes.

Differences in elevational preference between the sexes are known in other hummingbirds, such as Viridian Metaltail *Metallura williami* and Rufous-capped Thornbill *Chalcostigma ruficeps*, and possibly occur in the elfin forest specialist Black-breasted Puffleg *Eriocnemis nigriventris* (Collar *et al.* 1992). Observations of the sunangel were made in the middle of the dry season and there was no evidence of breeding. However, as some hummingbirds are altitudinally migratory, for

example Black-breasted Puffleg, it is possible that the dispersion of the male and female sunangels would have been different in the wet season. Further studies are needed in order to prove whether or not there are sexual differences in altitudinal preference in the sunangel and whether dispersion changes in the breeding season. An understanding of this is vital if this species is to be effectively protected.

Territorial behaviour

The following notes on behaviour were made in a male sunangel's territory at 1950 m during 11 hours of continuous observation from 07.00 to 18.00 h on 30 August. The territory appeared to be centred on the area with maximum abundance of *Brachyotum quinquenerve* that occurred 100 m from the edge of the elfin forest. The Royal Sunangel was often observed here either feeding on *B. quinquenerve* or perching in one of two dead trees, using the same branches 3.5 m above the ground. The use of favoured perches was also noted by Fitzpatrick *et al.* (1979). Our observations suggest that the male was defending the areas; he was seen chasing at least two other male sunangels and a female Green-tailed Trainbearer *Lesbia nuna* off the territory. While perched, the male continuously moved its head from side to side, occasionally straining forward, apparently scanning the area. Upon the appearance of another hummingbird of its own or a different species, the sunangel would emit a series of a very high-pitched *tick* notes (three per second) which continued until the intruder had been successfully chased away. However, no aggressive interactions between the male sunangel and Sparkling Violetear *Colibri coruscans* were witnessed. The latter, an often highly aggressive bird (*pers. obs.*), was regularly observed feeding upon a small patch of *B. quinquenerve*. Although this patch apparently fell inside the territory, the male sunangel was never seen feeding within it.

Numerous hummingbirds were observed feeding alongside Royal Sunangels at the lower altitude without any aggressive interactions. These included Booted Raquet-tail *Ocreatus underwoodii*, Green Violetear *Colibri thalassinus* and White-bellied Woodstar *Acestrura mulsant*.

Conservation status

The elfin scrub above the village of San Cristobal in the southern part of the Cordillera de Colán represents a new, and only the third, site for this threatened hummingbird. It was found to be locally common in a highly unusual habitat type. Not only were the patches of this habitat within our study area small, but it is likely to be restricted in extent on the mountain range as a whole, and it is highly vulnerable to degradation by man. In 1994, large-scale deforestation and rapid rates of habitat destruction were found on the Cordillera de Colán. This was in stark contrast to the situation in 1978 when large areas of forest were intact.

It is strongly recommended that a protected area be established urgently in the southern part of the mountain range where the largest areas of elfin scrub and adjacent elfin and cloud forest remain. Such a

reserve would protect not only elfin scrub and forest specialists such as the Royal Sunangel and Russet-mantled Soft-tail *Thripophaga berlepschi*, but also the other four threatened and six near-threatened bird species, and three threatened mammal species which were recorded in the area (Davies *et al.* 1994). The conservation measures should take advantage of the current opportunities provided by both an improved security situation and the local interest and desire to help conserve the remaining habitat (Davies *et al.* 1994). Conservation action must be initiated rapidly as it was locally estimated that, at the current rates of deforestation, all forest will be degraded within ten years. Effective conservation of remaining habitat on the Cordillera de Colán would significantly help to secure the future of the Royal Sunangel.

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